# 1 Water Is Life

**Water's special properties make clean water essential to all life. Human activity affects our limited supply of clean, usable water.**

## Estimated Time

Four or five 50-minute class sessions

## Technology Tools/Skills Used in Chapter

Water quality test kits, meters or other equipment. Kits, meters or other equipment may include thermometer, pH kit, conductivity meter, dissolved oxygen kit, nitrate kit, etc.

## Safety Precautions/Concerns

- Students and instructors must wear safety goggles for Activity 1.7.
- Use extra care when handling glass.

## Vocabulary

Aquatic resource
Clean Water Act
Conservation
Decompose
Dissolved oxygen
Hydrosphere
Inorganic
Natural resource
Organic
Pollution
Reservoir
Water pollution
Water quality

## Chapter Objectives

Students will be able to:

1. Relate how much fresh water is available for living organisms—including humans—to use. Compare/contrast this to the amount of salt water on Earth and to the total amount of all water on Earth. Explain why water is a natural resource that must be conserved.
2. Describe three special properties of water and justify why these are essential to life on Earth.
3. Using a specific example, explain how a technological solution to a problem can have both benefits and drawbacks such as risks or unintended consequences to aquatic resources in Missouri.
4. Decide whether water is polluted or clean and explain how water pollution affects aquatic life.
5. Explain how water's temperature affects the amount of oxygen dissolved in it.
6. Define water quality and give an example of how humans affect water quality.

## Targeted Grade-Level Expectations

**ES.3.A.6.a. Relate the comparative amounts of fresh water and salt water on the Earth to the availability of water as a resource for living organisms and human activity**

**ES.1.B.6.a. Recognize the properties of water that make it an essential component of the Earth system (e.g., its ability to act as a solvent, its ability to remain as a liquid at most Earth temperatures)**

**ES.3.A.6.b. Describe the affect of human activities (e.g., landfills, use of fertilizers and herbicides, farming, septic systems) on the quality of water**

**IS.1.C.6.a. Describe how technological solutions to problems (e.g., storm water runoff,** fiber optics, windmills, efficient car design, electronic trains without conductors, sonar, robotics, Hubble telescope) **can have both benefits and drawbacks (e.g.,** design constraints, **unintended consequences, risks)**

**IN.1.A.6.b. Recognize the importance of the independent variable, dependent variables,** control of constants, and multiple trials to the design of a valid experiment

**IN.1.A.6.c.** Design and **conduct a valid experiment**

**IN.1.B.6.a. Make qualitative observations using the** five **senses**

**IN.1.B.6.b. Determine the appropriate tools and techniques to collect data**

**IN.1.B.6.c. Use a variety of tools and equipment to gather data (e.g.,** microscopes, **thermometers,** computers, spring scales, balances, magnets, metric rulers, graduated cylinders, stopwatches**)**

**IN.1.B.6.d. Measure** length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, **temperature to the nearest degree Celsius,** force (weight) to the nearest Newton, time to the nearest second
**IN.1.B.6.e. Compare amounts/measurements**
**IN.1.C.6.a. Use quantitative and qualitative data as support for reasonable explanations (conclusions)**
**IN.1.C.6.b. Use data as support for observed patterns and relationships, and to make predictions to be tested**
**IN.1.E.6.a. Communicate the procedures and results of investigations and explanations through:**

- oral presentations
- drawings and maps
- data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
- graphs (bar, single line, pictograph)
- writings

## Reference Material for Teacher Background

- Instructions for water quality test kits, meters or other equipment
- Missouri DNR Water Pollution Control Website page at *dnr.mo.gov/env/wpp/wp-index.html*
- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Start a Missouri Stream Team (FIS182)
- Now That I'm a Stream Team (FIS188)
- *Stream Team Middle School Activity Guide* by Mark Van Patten, *mostreamteam.org/activity_guide/contents.htm*
- Streets to Streams Guide (E00428)
- Streets to Streams Video (E00447)
- Volunteer Water Quality Monitoring (FIS049)

## Required Materials

- 5-gallon bucket or aquarium filled with water
- 2-cup measure
- ½-cup measure
- 1-pound box of table salt
- Ice cubes
- Food coloring
- Paper towels for spills
- Three clear glass containers (beaker or drinking glass) filled with water
- Fresh celery stalk (Advanced preparation is required.)
- Knife
- Spoon or stirrer
- Bottle of warm seltzer
- Bottle of cold seltzer
- Container (paper cup) filled with water for each student or group
- Penny for each student or group
- Dropper for each student or group
- 2 Water Use Record sheets for each student
- Student Guide
- Safety goggles—one per student
- At least 2 water samples for each group pre-labeled A, B, etc. Sample sources may be tap water, rain water, pond water, etc. (Advanced preparation is required.)
- Water quality test kits, meters or other equipment. Kits, meters or other equipment may include thermometer, pH kit, conductivity meter, dissolved oxygen kit, nitrate kit, etc. (Advanced preparation is required.)
- Notebook paper
- Pens or pencils
- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- TV/DVD player

# Activity 1.1: Exploration of Students' Current Understanding of Water

This activity explores students' current understanding of the importance, availability and properties of water.

## Estimated Time

5 minutes

## Required Materials

None

## Procedure

1. Use a cooperative learning activity to explore the following questions:
   - How do you use water?
   - How much water do you use each day?
   - How much water exists on Earth?
   - Would you drink water from [name a local pond]? Why or why not?
   - Would you drink water from the Mississippi River? Why or why not?

2. Explain to the class that this chapter will help them understand the value, importance and properties of water, as well as some ways to determine whether water is clean or not.

# Activity 1.2: Teacher Demonstration of Water Distribution and Scarcity

This demonstration helps students visualize the comparative amount of fresh water and salt water on the Earth and the small portion available for human use.

## Estimated Time

10 minutes

## Required Materials

- 5-gallon bucket or aquarium filled with water
- 2-cup measure
- ½-cup measure
- Dropper
- One-pound box of table salt
- Ice cubes
- Food coloring
- Paper towels for spills

## Procedure

1. Explain that the aquarium or bucket represents all the water on Earth.

2. Remove 2 cups of water. Explain that this is all the fresh water on Earth and the rest is salt water. Pour salt into the aquarium or bucket and place the salt container in front of it. Remove ½ cup of water from the 2 cups. Explain that the 1½ cups remaining is frozen in polar ice caps and glaciers. Pour out the 1½ cups of water and replace with ice cubes. The ½ cup represents all the unfrozen fresh water found on the Earth's surface, in the ground and in the air.

3. Fill the dropper from the ½ cup and place one drop in a student's hand.

4. Ask students what they think this amount represents. (The portion of all the water on Earth that is available for human use.) Explain that the rest of the half cup is too polluted, inaccessible or too costly to transport. Place a few drops of food coloring in the ½ cup of water.

5. Lead class discussion of ways people use water and how animals and plants use water.

6. Explain that every living cell contains water.

# Activity 1.3: Teacher Demonstration of Properties of Water

This demonstration helps students understand the properties of water that make it an essential component of the Earth system.

## Estimated Time

15 minutes

## Required Materials

- Three clear glass containers (beaker or drinking glass) filled with water
- Fresh celery stalk
- Knife
- One-pound box of table salt
- Ice cubes
- Food coloring
- Spoon or stirrer
- Bottle of warm seltzer
- Bottle of cold seltzer
- Paper towels for spills

### Prepare a day in advance

**Add some food coloring to a container of water. Make a fresh cut across the bottom of a celery stalk and place the cut end in the container of colored water. Let it sit overnight.**

## Procedure

1. Tell the class that water can climb up tubes because it clings to things like the walls of the tubes. Explain that this clinginess allows water to climb up plant stems and enables blood to flow through our bodies. Show students that the colored water has traveled up the celery stalk and is visible in the veins of the plant.

2. Tell the class that, for most substances, the solid state is denser than the liquid state. Retrieve another container of water and ask the class what will happen when you place some ice cubes in liquid water. (The ice will float.) Place a few cubes of ice in the container of liquid water. Explain that the ice floats because it is less dense than the liquid, and that without this property, lakes would freeze solid in winter, killing fish and other aquatic life.

3. Retrieve the third container of water and the box of salt. Begin adding salt to the water and stirring. Ask students to say stop when they think no more salt will dissolve. (500 milliliters of water will dissolve 180 grams or about 17 teaspoons of salt in 2 cups of water at room temperature.) Lead class discussion about the importance of water's ability to dissolve things.

4. Retrieve the two bottles of seltzer. Ask the class what will happen when you open the warm one vs. the cold one. (The warm one will spew out more forcefully.) Open each bottle over a sink (or have paper towels handy). Explain that cold water can dissolve more gas, and that the spewing is due to dissolved gas escaping from the warmer water. Explain that aquatic animals depend on water's ability to hold dissolved oxygen.

# Activity 1.4: Student Investigation of Surface Tension

This hands-on activity helps students understand the property of surface tension.

## Estimated Time

10 minutes

## Required Materials

- Container (paper cup) filled with water for each student or group
- Penny for each student or group
- Dropper for each student or group
- Paper towels for spills

## Procedure

1. If necessary, divide students into groups. Otherwise each student may work independently.

2. Ask the class how many drops of water can fit on a penny. Note answers on the board for later reference.

3. Give each student or group a penny, a dropper and a container of water. Be sure to have paper towels on hand for spills.

4. Instruct students to place the penny on the desktop, and place water on the face of the penny a drop at a time.

5. Have them count the number of drops they can fit before water runs off.

6. Lead class discussion of what they observed. Be sure to introduce and explain the term **surface tension**. Refer to their hypotheses noted on the board and to their observed results.

7. Use a cooperative learning activity to lead class discussion of the properties of water. Ask students to give examples from nature and from their daily lives of how the properties of water may be observed and why they are important.

# Activity 1.5: Student Investigation of Water Consumption

This activity helps students understand their own use of water, and helps students recognize independent *vs.* dependent variables and experimental constants.

## Estimated Time

35 minutes of in-class time over three consecutive days (10-, 10- and 15-minute discussions)

## Required Materials

- 1 Water Use Record sheet for each student
- 1 Bar Graph Template sheet for each student
- Pens or pencils

## Procedure

**Day one** (10 minutes)

1. Distribute a Water Use Record sheet to each student.

2. Instruct students to use the sheet to record their water use for the next 24 hours and bring the completed page to class the next day.

**Day two** (10 minutes)

1. Lead class discussion of water use findings. Tabulate results on the board and calculate a class water use total. Ask students how they could reduce their daily water use. Ask students to agree upon one thing they will all change about their daily water use to conserve water ( for example, take a shorter shower). Alternatively, students may be divided into groups, with each group choosing a different water use to change.

2. Using the Water Use Record sheet, instruct the students to record their water use for the next 24 hours (Day 2), changing the agreed-upon use, and bring the completed page to class the next day.

**Day three** (15 minutes)

1. Ask students to identify the constants and the dependent and independent variables in their water conservation experiment. (**Independent variables** are the water use habits they changed; a **dependent variable** is the amount of water they used; **constants** include the person using the water and recording water use, and the water use habits they did not change.)

2. Lead class discussion of water use findings. Tabulate results on the board and calculate a class water use total. If students worked in groups, compare water use and conservation results between groups. Lead class discussion about water conservation and challenge them to make their water use changes permanent.

3. Using their Personal Water Use information, instruct the students to create a bar graph on the template provided to show their results.
   Be sure that they know to provide the following:
   - An appropriate title
   - A label for each axis with appropriate units
   - An appropriate number scale and category labels
   - Correctly plotted data

4. Have students add the Water Use Record sheets to their science notebooks.

# WATER USE RECORD



## Objective

Record and present personal water usage data.

## Directions

1. Using the charts below, make a tick mark in the appropriate box each time (or per minute, for showers) you use water.

2. Multiply the number of "Times" (or minutes, for showers) by the "Gallons per time" and place that number in the column "Total gallons per activity."

3. Add the "Total gallons per activity" column and enter the total in the last box.

4. Using your Personal Water Use information, create a bar graph on the template provided to show your results. Be sure to provide the following:
   - An appropriate title
   - A label for each axis with appropriate units
   - An appropriate number scale and category labels
   - Correctly plotted data

Name: _____ Date: _____

## Personal Water Use—Day 1

| Activity | Times | Gallons per time | Total gallons per activity |
|---|---|---|---|
| Flush a toilet | | 4 | |
| Brush teeth with water running | | 3 | |
| Take a shower (count minutes) | | 5 per minute | |
| Take a bath | | 20 | |
| Eat one meal | | 2.5 | |
| **Total** | | | |

## Personal Water Use—Day 2

Date: _____

| Activity | Times | Gallons per time | Total gallons per activity |
|---|---|---|---|
| Flush a toilet | | 4 | |
| Brush teeth with water running | | 3 | |
| Take a shower (count minutes) | | 5 per minute | |
| Take a bath | | 20 | |
| Eat one meal | | 2.5 | |
| **Total** | | | |

# BAR GRAPH TEMPLATE



**Name:** _____

**Date:** _____

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# Activity 1.6: Student Reading and Research

This activity provides students with definitions and explanations about the importance of water, its distribution, scarcity, conservation and special properties. It introduces the concepts of water pollution and water quality, and describes how water can be tested for pollution.

## Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

## Required Materials

- Student Guide
- Notebook paper (optional)
- Pens or pencils (optional)

## Procedure

1. Have students read Chapter 1: Water Is Life. Introduce vocabulary terms as needed.
2. Assign the **Questions to Consider** as homework or use them in a cooperative learning activity.
    1. Why is water important? What is the hydrosphere?
    **Water is essential to all life. The hydrosphere is all the water on Earth.**
    2. What are natural resources? What are aquatic resources?
    **Natural resources are anything found on Earth that can't be made by humans. Aquatic resources are water and all things that live in or around water.**
    3. How do we use water? How much water is available for human use? What is conservation? Why is it important?
    **Uses of water may include drinking, cooking, washing, growing crops, generating power, manufacturing, transportation, etc. The amount of water available for human use may be described as less than 0.003 percent, a tiny fraction of all water or about 2 million gallons per person. Conservation is careful use. Water (and other resources) are essential and in limited supply.**
    4. What are the special properties of water? Why are they important?
    **Answers may include:**

| Water Property | Importance |
|---|---|
| can take three forms: liquid, solid and vapor | • permits self-purifying (water) cycle |
| solid form (ice) is not as dense as liquid form | • ice floats and lakes do not freeze solid, trapping and killing fish and other aquatic life<br>• can break rocks by freezing and thawing |
| dissolves many different things | • aquatic animals and plants can live and grow under water<br>• animals and plants can draw nutrition from water |
| molecules attract one another, creating surface tension | • things can float on surface<br>• forms drops |
| molecules cling to other things | • water can climb up plant roots and stems<br>• blood can flow through tiny blood vessels |
| has a high boiling point and a low freezing point; can absorb a lot of heat before it begins to get hot | • provides living things a fairly constant environment |
| transparent to light | • plants can live under water |

5. How can we tell if water is polluted or clean? How does water pollution affect aquatic life?
   **We tell if water is polluted or clean by determining its quality using physical, chemical and biological tests. Some ways water pollution affects aquatic life include:**
   - **Cloudy water blocks light and slows plant growth.**
   - **Too much fertilizer causes overgrowth of algae.**
   - **Toxic chemicals are poisonous to living things.**
6. How does water's temperature affect the amount of oxygen in it?
   **Cold water holds more oxygen.**
7. What is water quality? How do humans affect water quality?
   **Water quality is water's fitness for a particular use.**
   **Humans affect water quality by polluting or conserving water. Answers may include specific examples.**

# Activity 1.7: Student Investigation of Water Quality

This hands-on activity introduces students to technology and methods for testing water for pollution and determining water quality. Students practice using water chemistry test kits and equipment in class. Students use water chemistry data to identify source of water samples.

## Estimated Time

One 50-minute class followed by 25 minutes of discussion the next day.

## Safety Precautions/Concerns

- Students and instructors must wear safety goggles for Activity 1.7.
- Use extra care when handling glass.

## Required Materials

- Safety goggles—one per student
- At least two water samples for each group pre-labeled A, B, etc. Sample sources may be tap water, rain water, pond water, etc. (Advanced preparation is required.)
- Water quality test kits, meters or other equipment. Kits, meters or other equipment may include thermometer, pH kit, conductivity meter, dissolved oxygen kit, nitrate kit, etc. (Advanced preparation is required.)
- Water Chemistry Investigation sheet for each student. (Table may require modification depending on number of water samples and water quality test kits, meters or other equipment used.)

## Procedure

**Day one** (50 minutes)

1. Prepare in advance by setting up the room. If there are enough water samples and water quality test kits or equipment, distribute a set for each group. Alternatively, provide water samples to each group and set up stations around the room where groups take turns using the test kit or equipment at each station to test their water samples. Or set up stations around the room with a water sample at each station where groups take turns using their test kits or equipment.

2. Distribute a Water Chemistry Investigation sheet to each student.

3. Divide students into groups. Tell students the sources of the water samples (e.g., tap water, rain water, pond water, etc.), and explain that they must figure out which is which by testing the samples.

4. Have students record observations about color and odor for each water sample.

5. Demonstrate the use of each kit, meter or other equipment according to the directions accompanying it, and guide students through their use. Have students test each sample and record their results.

- **pH** is a measure of acidity. Pure water has a pH of 7, which is considered neutral. In the United States, most rainwater is moderately acidic (5.5) due to contamination from acid-forming gasses in the air. These gasses include carbon dioxide, sulfur dioxide and nitrogen oxides. They come from the burning of fossil fuels. Water from Missouri's rivers and streams is usually slightly basic (7.8). This is because of Missouri's limestone/dolomite bedrock. Limestone neutralizes and buffers the acidity of rainwater. Acidity can cause toxic heavy metals to dissolve into the water.
- **Conductivity** measures how easily electricity flows through the water. Salts dissolved in water allow it to conduct more electricity. Other substances that may not be dissolved but are suspended in the water cause it to conduct electricity more easily. These may also cause the water to appear cloudy or dark. Some common causes of higher conductivity include wintertime road salt, animal (including human) waste and eroded soils that have washed into the water.
- **Dissolved oxygen** is important to support aquatic life. In general, higher dissolved oxygen is better. Air is 21 percent oxygen or 210,000 parts per million. Most of Missouri's water bodies are 0.0005-0.0015 percent oxygen or between 5 and 15 parts per million.
- **Nitrates** can come in many forms. Fertilizer and animal (including human) waste are common sources of nitrates in Missouri's waters. Nitrates may stimulate plant growth. When water is basic, nitrates may form toxic ammonia compounds.

6. Have students place the completed data sheets in their science notebooks.

7. Have students clean up and prepare kits, meters or equipment for use by the next group or class.

**Day two** (25 minutes)

1. Use a cooperative learning activity to lead class discussion of water chemistry. Ask students to consider what it means for one water sample to have a higher or lower pH, conductivity, dissolved oxygen level or nitrate content than another. Have students take notes in their science notebooks describing the meaning of each characteristic.

2. Lead class discussion of students' water chemistry findings and their hypotheses about the source of each of the water samples. Ask the students which sample they'd rather drink and why.

3. Reveal source of each of the water samples (e.g., A is tap water, B is rain water, C is pond water, etc.) and discuss. Be sure to address students' misconceptions about the meaning of each water chemistry characteristic.

# WATER CHEMISTRY INVESTIGATION



## Objective

Test physical and chemical characteristics of unknown water samples, record and present data and identify source of each sample.

## Directions

1. Work with your partners following your teacher's instructions to conduct a valid experiment.
2. Record your group's observations about the color and odor of each water sample in the table below.
3. Following the directions for each meter, test kit or other equipment to test each water sample and record data in the table below.
4. When you have completed the activity, follow your teacher's instructions to clean up and prepare kits, meters and other equipment for use by the next group or class.
5. Discuss the results within your group and formulate a hypothesis identifying the source of each of the water samples. Record your hypothesis in the last (right-most) column of the table.

**Group: _____ (names)**

**Date: _____**

## Physical and chemical characteristics of unknown water samples

| Water sample | Temperature (°C) | Color | Odor | pH | Conductivity _____ (units) | Dissolved oxygen _____ (units) | Nitrates _____ (units) | Water sample source |
|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | |
| B | | | | | | | | |
| C | | | | | | | | |
| D | | | | | | | | |
| E | | | | | | | | |

# Activity 1.8: Student Investigation of Water Quality

Students apply what they have learned in the preceding activities to create science notebook pages to record water chemistry data and observations in preparation for their field study day.

## Estimated Time

25 minutes

## Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- TV/DVD player
- Notebook paper
- Pens or pencils

## Procedure

1. Show and discuss video clip "Storm Drain Stenciling."

2. Instruct students to work in groups to decide the best way to record water chemistry data and observations as part of their field study day.

3. Have each group create a data table and have each student place a copy in his/her science notebook.

# Chapter 1 Assessment



## Directions

Select the best answer for each of the following multiple-choice questions.

1. What proportion of the water on the earth is fresh water?
   a. 3 percent
   b. 25 percent
   c. 75 percent
   d. 97 percent

2. What is water quality?
   a. Rainwater running off hot pavement can dump hot water into a stream, killing everything in it
   b. Water's fitness for a particular use
   c. Water used mainly for agriculture
   d. All of the above

3. Water is a unique substance. It can be found in all three states on Earth—solid, liquid and gas. Which of the following are other properties of water?
   a. Exhibits surface tension
   b. Acts as a solvent
   c. Is transparent
   d. All of the above

4. In the experiment in which you recorded your daily water use, what was a constant?
   a. The person using the water
   b. The amount water used
   c. The ways in which water was used
   d. The temperature of the water

5. How does water pollution affect aquatic life?
   a. Cloudy water blocks light and slows plant growth
   b. Too much fertilizer causes overgrowth of algae
   c. Toxic chemicals are poisonous to living things
   d. All of the above

6. How do humans affect water quality?
   a. By making Missouri's waters home to over 200 kinds of fish
   b. By creating surface tension
   c. By giving water a high boiling point and a low freezing point
   d. By polluting or conserving water

7. What is the hydrosphere?
   a. All the fresh water on Earth
   b. All the water on Earth
   c. Two hydrogen atoms and one oxygen atom bonded together
   d. None of the above

8. What are natural resources?
   a. Any recyclable substance
   b. Anything made in a factory
   c. Anything found in the hydrosphere
   d. Anything found on Earth that can't be made by humans

9. What is conservation?
   a. Careful use
   b. Thinking very hard
   c. Taking anything we want
   d. Taking water for granted

10. How does water's temperature affect the amount of oxygen in it?
    a. Cold water floats.
    b. Liquid water turns to gas.
    c. Cold water holds more oxygen.
    d. Oxygen is vital for life.

# Chapter 1 Assessment

Copy Page

## Directions

Write your own answer for each of the following questions.

1. How much fresh water is available for living organisms—including humans—to use? Compare this to the amount of salt water on Earth and to the total amount of all water on Earth. Explain why water is a natural resource that must be conserved.

2. Assess how human activities affect the quality of water. Using a specific example, show how a technological solution (such as farm irrigation, paved roads and parking lots, sewer systems, use of fertilizers and herbicides, etc.) to a problem can have both benefits and drawbacks (such as risks or unintended consequences) to aquatic resources in Missouri.

3. On a separate sheet of paper, create a chart to describe three special properties of water and to justify why these are essential to life on Earth.

# Chapter 1 Assessment Answer Key

## Multiple-choice questions

1. What proportion of the water on the earth is fresh water?
   **a. 3 percent**

2. What is water quality?
   **b. Water's fitness for a particular use**

3. Water is a unique substance. It can be found on Earth in all three states—solid, liquid and gas. Which of the following are other properties of water?
   **d. All of the above**

4. In the experiment in which you recorded your daily water use, what was a constant?
   **a. The person using the water**

5. How does water pollution affect aquatic life?
   **d. All of the above**

6. How do humans affect water quality?
   **d. By polluting or conserving water**

7. What is the hydrosphere?
   **b. All the water on Earth**

8. What are natural resources?
   **d. Anything found on Earth that can't be made by humans**

9. What is conservation?
   **a. Careful use**

10. How does water's temperature affect the amount of oxygen in it?
    **c. Cold water holds more oxygen**

## Write-in questions

1. How much fresh water is available for living organisms—including humans—to use? Compare this to the amount of salt water on Earth and to the total amount of all water on Earth. Explain why water is a natural resource that must be conserved.
   **Answers should include:**
   - **Less than 0.003 percent or a tiny fraction or about 2 million gallons per person**
   - **97 percent of all the Earth's water is salt water**
   - **Water is essential to all life**
   - **No new water can be made**

2. Assess how human activities affect the quality of water. Using a specific example, show how a technological solution (such as farm irrigation, paved roads and parking lots, sewer systems, use of fertilizers and herbicides, etc.) to a problem can have both benefits and drawbacks (such as risks or unintended consequences) to aquatic resources in Missouri.
   **Answers may include:**

| Activity/technological solution | Potential benefit | Potential drawback |
|---|---|---|
| paved roads/parking lots | improve surface transportation | water running off surface carries heat and pollutants |
| farm irrigation | improves food production | uses/wastes too much water |
| use of fertilizers | increases plant growth | results in overgrowth of algae |
| sewer systems | carry away waste | contaminate water bodies |
| use of herbicides | kills weeds | toxic to other plants and animals |

3. On a separate sheet of paper, create a chart to describe three special properties of water and to justify why these are essential to life on Earth.
   **Answers may include:**

| Property | Importance |
|---|---|
| can take three forms: liquid, solid and vapor | • permits self-purifying (water) cycle |
| solid form (ice) is not as dense as liquid form | • ice floats and lakes do not freeze solid, trapping and killing fish and other aquatic life<br>• can break rocks by freezing and thawing |
| dissolves many different things | • aquatic animals and plants can live and grow under water<br>• animals and plants can draw nutrition from water |
| molecules attract one another, creating surface tension | • things can float on surface<br>• forms drops |
| molecules cling to other things | • water can climb up plant roots and stems<br>• blood can flow through tiny blood vessels |
| has a high boiling point and a low freezing point; can absorb a lot of heat before it begins to get hot | • provides living things a fairly constant environment |
| transparent to light | • plants can live under water |

# Enrichments

## Project WET:

- Adventures in Density
- Choices and Preferences, Water Index
- Common Water
- Drop in the Bucket
- Every Drop Counts
- H2Olympics
- Hangin' Together
- Is There Water on Zork?
- Water Meter
- What's the Solution?

## Project WILD Aquatic:

- How Wet Is Our Planet?
- Something's Fishy Here!
- What's in the Water?

## Video clips:

- Mississippi River Maintenance Man
- Missouri River Relief

## Guest speakers:

- Department of Natural Resources water resource professional. If invited for Activities 1.7 or 1.8, the speaker may be able to assist with instruction as well as talk about careers and clean water issues.
- Stream Team volunteer water quality monitor. If invited for Activities 1.7 or 1.8, the speaker may be able to assist with instruction as well as talk about volunteer opportunities and clean water issues.